MICROSOFT VS. GOOGLE: THE BATTLE FOR THE QUANTUM CHIP

Status 2026 – reliability, stability, and scalability

NOTE
This document is an ordered text version of image 2. The figures and claims have been taken from that infographic and have not been independently scientifically or journalistically verified here.

1. MICROSOFT – MAJORANA 2

Technology

Topological qubits based on Majorana particles.

Announcement

According to the infographic, Microsoft unveiled Majorana 2 in June 2026 as the successor to Majorana 1.

Main claims

- 1,000× more reliable thanks to an AI-discovered material improvement in which aluminium was reportedly replaced by lead.
- Longer lifetime: the qubits are said to remain stable for an average of approximately 20 seconds, compared with milliseconds for Majorana 1.
- Accelerated roadmap: a commercially useful quantum computer may be possible in 2029 instead of 2033.

Specifications according to the infographic

- Qubit type: topological, based on Majorana particles.
- Number of qubits in the current generation: approximately 100 in prototype form.
- Qubit coherence time: an average of approximately 20 seconds.
- Two-qubit gate error rate: approximately 0.1%, or about 1 in 1,000.
- Quantum error correction: still under development; in theory, less error correction would be required because of topological protection.
- Status: promising prototype.
- Roadmap to a commercial system: 2029, previously 2033.
- Theoretical scalability potential: very high, because topological qubits would require less error correction.
- Operating temperature: close to absolute zero, in the millikelvin range.

Reliability

- According to the infographic, 1,000× better than Majorana 1.
- Topological protection would make qubits naturally less sensitive to errors.
- According to the infographic, no large-scale practical tests have yet been published.
- Rating in the image: 3 out of 5 stars.

Stability

- Approximately 20 seconds of coherence time.
- The image describes this as revolutionary for topological qubits.
- Goal for future generations: stability ranging from minutes to hours.
- Rating in the image: 4 out of 5 stars.

Scalability and production

- A new lead-based material stack is said to be used, making integration easier.
- The theoretical number of physical qubits per chip could become very high.
- Production is still at an early stage.
- Rating in the image: 3 out of 5 stars.

2. GOOGLE – WILLOW AND THE DUAL-TRACK STRATEGY

Technology

Superconducting transmon qubits, supplemented by research into neutral atoms.

Main hardware

The Willow chip with 105 qubits.

Key points

- Google uses superconducting transmon qubits, a technology that has been studied for a longer time.
- According to the infographic, quantum error correction has been successfully demonstrated: errors would decrease as the system becomes larger.
- Google follows a dual-track strategy in which neutral atoms are researched alongside superconducting chips to determine which technology scales best.

Specifications according to the infographic

- Qubit type: superconducting transmon qubits and neutral atoms.
- Number of qubits: 105 on the Willow processor.
- Average coherence time: approximately 100 microseconds, or 0.0001 seconds.
- Error rate: approximately 0.1% to 1%, depending on the operation.
- Quantum error correction: actively demonstrated; errors decrease as the system becomes larger.
- Status: available to selected researchers through Google Quantum Cloud.
- Roadmap to a commercial system: no public date; gradual scaling through the cloud.
- Scalability potential: high, although relatively many physical qubits are needed for error correction.
- Operating temperature: close to absolute zero, in the millikelvin range.

Reliability

- According to the infographic, error correction has been demonstrated in increasingly large systems.
- Reproducible results have been obtained on real hardware.
- Google uses AI for calibration and optimisation.
- Rating in the image: 4 out of 5 stars.

Stability

- Approximately 100 microseconds of coherence time on current chips.
- Neutral atoms could potentially remain stable for seconds to minutes.
- Rating in the image: 4 out of 5 stars.

Scalability and production

- Superconducting chips can be manufactured iteratively at wafer level.
- Neutral atoms could scale modularly through optical systems.
- The cloud platform enables rapid access for researchers.
- Rating in the image: 4 out of 5 stars.

3. WHAT CAN THESE QUANTUM CHIPS CALCULATE?

Chemistry and materials

- Simulations of molecules.
- Development of new medicines.
- Design of catalysts.

Optimisation

- Logistics.
- Routing.
- Energy grids.
- Financial models.

AI and machine learning

- Model training.
- Pattern recognition.

Cryptography

- Breaking or creating advanced encryption.

4. THEORETICAL SPEED ADVANTAGES FOR SPECIFIC PROBLEMS

Various simulations in chemistry and materials

- Microsoft Majorana 2: theoretically 10^6 to 10^12 times faster.
- Google Willow: theoretically 10^4 to 10^10 times faster.

Combinatorial optimisation problems

- Microsoft Majorana 2: theoretically 10^5 to 10^10 times faster.
- Google Willow: theoretically 10^3 to 10^7 times faster.

Cryptography, for example RSA-2048 factorisation using Shor’s algorithm

- Microsoft Majorana 2: more than 10^9 times faster.
- Google Willow: more than 10^9 times faster.

Certain AI and machine-learning tasks

- Microsoft Majorana 2: theoretically 10^3 to 10^6 times faster.
- Google Willow: theoretically 10^2 to 10^4 times faster.

Important limitation

These figures apply only to specific types of calculations and are not a general speed measurement for all computing tasks.

5. CONCRETE EXAMPLE: SIMULATION OF A COMPLEX MOLECULE

Microsoft Majorana 2

A simulation that, according to the infographic, would take approximately 10,000 years on a supercomputer could be completed with Majorana 2 in a few minutes to a few hours.

Google Willow

The same simulation, which would take approximately 10,000 years on a supercomputer, could, according to the infographic, be completed with Willow in a few hours to a few days.

6. COMPARISON WITH A CLASSICAL SUPERCOMPUTER

Example of a leading supercomputer in 2026

- Systems mentioned: Frontier in the United States and Aurora in the United States.
- Peak performance: approximately 2 exaFLOPS, or around 2 × 10^18 calculations per second.
- Energy consumption: approximately 20 to 30 megawatts.
- Cost: approximately 600 to 700 million US dollars.
- Size: many thousands of square metres of infrastructure.

Current-generation quantum chips

- Not yet a universal replacement for classical supercomputers.
- According to the infographic, they may have a major advantage for certain calculations.
- Energy consumption: from kilowatts to low megawatt levels.
- Access: through the cloud at Google and limited access at Microsoft.
- Potentially thousands to millions of times more energy-efficient for suitable problems.

7. THE CURRENT STANDING

Microsoft

According to the infographic, Microsoft has significantly improved its own technology with Majorana 2 and may have the greatest long-term potential for highly stable qubits and large-scale scalability.

Google

According to the infographic, Google has a more concrete machine in Willow, which is already being used by scientists and is producing measurable results.

Summary

- Microsoft: stronger theoretical long-term potential, but less proven in practice.

- Google: more concrete, more measurable, and already accessible technology.
- There is no definitive winner yet.

8. THE FUTURE

According to the infographic, neither technology is fully ready. Together, however, they may mark the beginning of the end of a world dominated exclusively by classical supercomputers.

Expectation in the image

Over the next five to ten years, quantum computers could take over an increasingly large share of the most demanding calculations for which they are suitable.

Closing statement from the infographic

“The revolution has begun. Quantum is no longer the future – it is now.”

Sources listed in the infographic

Microsoft, Google, Nature, arXiv, and Quantum Insider, covering the period 2024–2026.

Warning from the infographic

All figures are based on public announcements and estimates up to June 2026 and may change.